

**What is claimed is:**

1. A lithographic projection apparatus comprising:
  - an illuminator configured to provide a projection beam of radiation;
  - a support configured to hold a patterning device, the patterning device configured to pattern the projection beam according to a desired pattern;
  - a substrate table configured to hold a substrate;
  - a projection system configured to project the patterned beam onto a target portion of the substrate;
  - an alignment system;
  - a predictive control system configured to generate a control signal to effect a compensation for a time-varying property of a part of said apparatus; and
  - a comparator configured to compare said control signal to a threshold and generate a trigger signal when said control signal is greater than said threshold,
  - wherein said alignment system is configured to perform an alignment process in response to said trigger signal.
2. Apparatus according to claim 1 wherein said comparator compares the change in said control signal since an alignment was last performed to said threshold.
3. Apparatus according to claim 1 further comprising a threshold determining unit configured to increase said threshold each time an alignment process is performed.
4. Apparatus according to claim 1 wherein said predictive control system generates a control signal to effect a compensation for the change in said property since the last time an alignment process was performed.
5. Apparatus according to claim 1 wherein said time varying property is an optical property of said projection system that changes due to heating effects.
6. Apparatus according to claim 5 wherein said optical property is magnification.

7. Apparatus according to claim 1 further comprising an input device configured to receive a user input of a value to be said threshold.
8. Apparatus according to claim 1 wherein said alignment system is configured to perform a first alignment process and a second alignment process that provides a larger number of measurements than said first alignment process, and wherein said alignment system is configured to perform said second alignment process in response to said trigger signal.
9. A device manufacturing method using a lithographic projection apparatus, the method comprising:
  - providing a substrate that is at least partially covered by a layer of radiation-sensitive material;
  - providing a projection beam of radiation using an illuminator;
  - using a patterning device to endow the projection beam with a pattern in its cross-section;
  - projecting the patterned beam of radiation onto a target portion of the layer of radiation-sensitive material using a projection system;
  - predicting a value of a time-varying property of a part of said apparatus at the time of a particular exposure;
  - applying a compensatory adjustment on the basis of said predicted value during said particular exposure;
  - detecting when said predicted value exceeds a threshold; and
  - in response to a detection that said predicted value exceeds said threshold, carrying out an alignment process.
10. The method according to claim 9 wherein said detecting comprises detecting when the change in said predicted value since an alignment was last performed exceeds said threshold.
11. The method according to claim 9 further comprising increasing said threshold each time an alignment process is performed.

12. The method according to claim 9 wherein in said predicting the value of a change in said property since the last time an alignment process was performed is predicted.

13. The method according to claim 9 wherein said time varying property is an optical property of said projection system that changes due to heating effects.

14. The method according to claim 13 wherein said optical property is magnification.

15. The method according to claim 9 wherein said alignment process includes a determination of the position of aerial images of a plurality of markers of said patterning device.

16. A computer-readable storage medium having stored thereon a computer program executable in the control system of a lithographic projection apparatus, said computer program comprising instructions to perform:

- predicting a value of a time-varying property of a part of said apparatus at the time of a particular exposure;
- applying a compensatory adjustment on the basis of said predicted value during said particular exposure;
- detecting when said predicted value exceeds a threshold; and
- in response to a detection that said predicted value exceeds said threshold, carrying out an alignment process.

17. A lithographic projection apparatus comprising:

- an illuminator configured to provide a projection beam of radiation;
- a support configured to hold a patterning device, the patterning device configured to pattern the projection beam according to a desired pattern;
- a substrate table configured to hold a substrate;
- a projection system having a magnification configured to project the patterned beam onto a target portion of the substrate;
- an alignment system configured to align a substrate held on said substrate table;
- a predictive control system configured to generate a control signal to effect a compensation for change in said magnification of said projection system due to heating

of elements thereof; and

- a comparator configured to compare the change in said control signal since the last time an alignment process was performed to a threshold and generate a trigger signal when said change in said control signal is greater than said threshold,
- wherein said alignment system is configured to perform an alignment process in response to said trigger signal.

18. A lithographic projection apparatus comprising:

- an illuminator for providing a projection beam of radiation;
- a support for holding a patterning device, the patterning device serving to pattern the projection beam according to a desired pattern;
- a substrate table for holding a substrate;
- a projection system for projecting the patterned beam onto a target portion of the substrate;
- an alignment system for aligning a substrate held on said substrate table;
- means for generating a control signal to effect a compensation for a time-varying property of a part of said apparatus; and
- means for comparing said control signal to a threshold and generating a trigger signal when said control signal is greater than said threshold,
- wherein said alignment system is configured to perform an alignment process in response to said trigger signal.